Space Weather Technical Forecast

Issued on Saturday 1 March 2025 at 01:07 Local

This technical forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of isolated M-class flares. Chance G1-G2/Minor-Moderate Storms day 1 (01 Mar).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Low with occasional C-class flares. Peak flare was C5.2 at 28/1628 UTC from AR4006 in the north-centre disc, however this region has seen a gradual decline. There are seven regions currently on the Earth-facing disc. The most notable of these are AR4007, just west of the south-centre disc and AR4009 in the northwest, as these have both shown development. AR4007 is a very small region, but with an unusual magnetic structure, with both its trailer and leader of positive polarity and with negative intermediate spots. AR4009 is magnetically simpler, maturing into a bipolar group, but continues to show some ongoing growth. The other regions remain smaller and simpler.

No Earth directed CMEs occurred. A broad ejection to the west was determined to be from an eruption just over the northwest limb, while the C5.2 flare of AR4006 produced a CME that will pass well to the north of Earth.

Solar Wind / Geomagnetic Activity: Connection to CH19/+ was observed through this period. Solar wind speed, as measured by ACE at L1, was initially Elevated at just under 600km/s, then rose to become Strong from around 28/1100 UTC to peak around 770km/s by 28/1730 UTC, before easing a little back to around 700km/s by 01/0000 UTC. Density was around or below average. Interplanetary Magnetic Field, Bt, eased from Moderate, at 13nT, to be Weak at around 8nT. The north-south component, Bz, was Moderate at times, varying between +11/-10nT at first, but tended to be Weak and predominately positive (northward) from 28/1530 UTC. Phi angle was positive (away from the Sun). Geomagnetic activity was Unsettled to G1/Minor Storm (Kp3-5), with these Minor Storms observed 28/0000-0300 UTC, 28/0600-0900 UTC and 28/1200-1500 UTC.

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) at GOES18 eased to be at background, after recent enhancements. High energy electron flux was Background to Moderate. The 24-hour fluence was below the Active threshold (1e8 integrated pfu), recording 8.5e6 integrated pfu at 01/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be Low to Moderate with an ongoing chance of isolated M-class flares.

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Solar Wind / Geomagnetic Activity: There is a chance of glancing CME impact early on 01 Mar, from the filament eruption off the east disc on 26 Feb. Otherwise ongoing fast wind influence from CH19/+ at first is expected to gradually ease, with Strong winds gradually and erratically easing to Background. Quiet to Active geomagnetic activity at first, but a chance for G1-G2 Minor to Moderate storm intervals if any CME glance occurs early on day 1 (01 Mar). Activity becoming mainly Quiet with isolated Unsettled intervals by day 3 (03 Mar).

Energetic Particles / Solar Radiation: High energy proton flux is likely to be at background levels. There remains a slight but declining chance of further enhancements, should any larger flares occur from AR3998. High energy electron flux is likely to increase during this period. The associated 24 hour fluence also has the potential to rise, with a chance of breaching the Active (1e8 integrated pfu) threshold by Day 4 (03 Mar).

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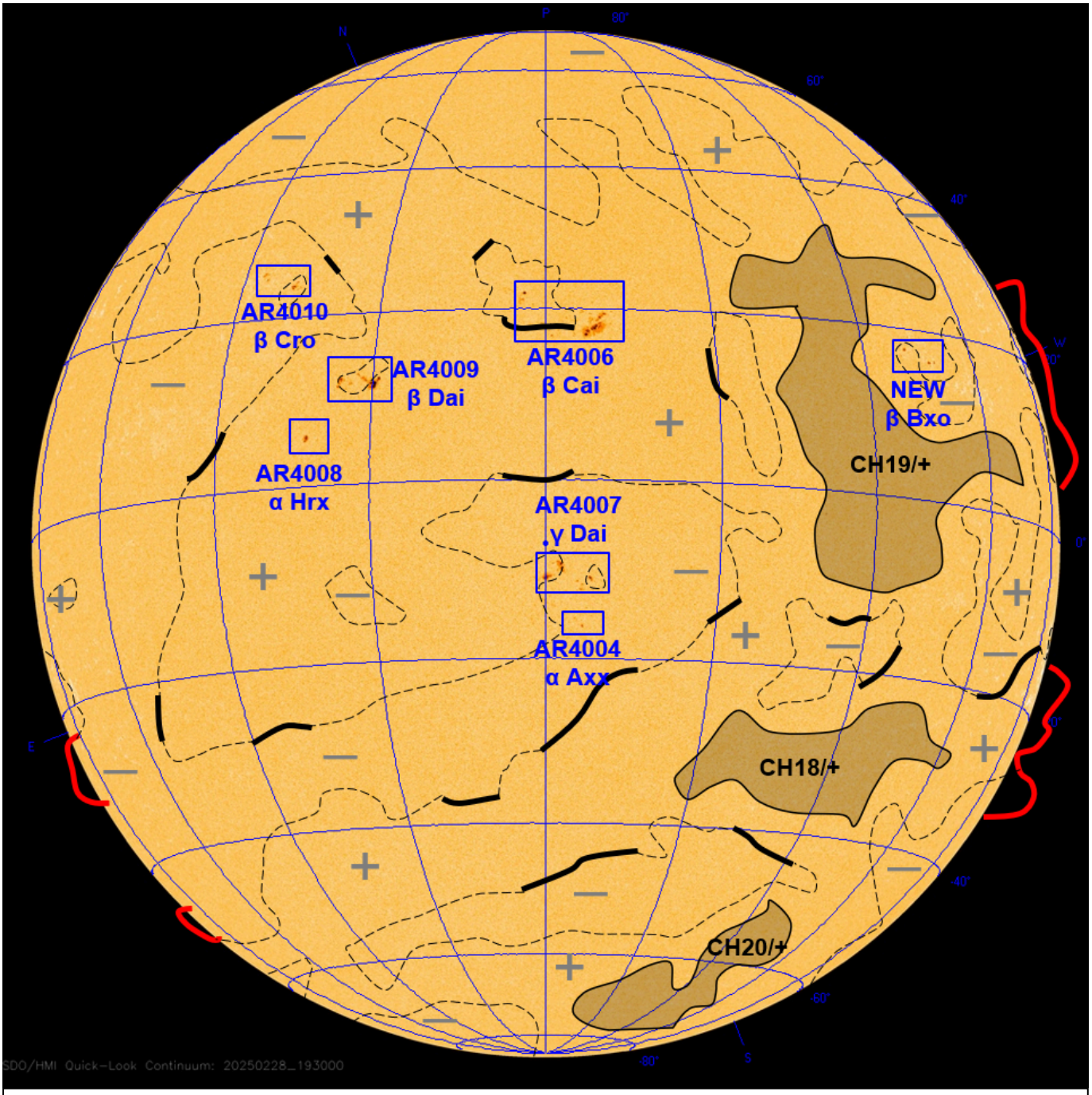
Figure 1: MOSWOC Solar Synoptic Map 28/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms

There remains one CME which is still anticipated to pass close to Earth early on day 1 (01 May). This is the filament eruption from the east disc on 26 Feb, although the subsequent CME was perhaps deflected further east away from Earth leading to low confidence. Despite this Enlil shows a very small impact, and this would correspond with the observed slight enhancement observed at Solar Orbiter around 28/1200 UTC. While better located to observed this CME, at 15 E comparted to Earth at 0E, this suggests any potential glance occurring early day 1 (01 Mar). The other CMEs, including from the C3.6 flare of AR3998 on 25 Feb, and filament eruption from centre disc on 26 Feb, are not expected to be observed at Earth.

Otherwise current fast winds are expected to gradually ease from later on day 1 (01 Mar) back towards background by the end of the period. There are no other enhancements currently expected through the period.

Quiet to Active geomagnetic conditions at first, with the chance of isolated G1-G2 Minor to Moderate storms if any glancing CME is observed on day 1 (01 Mar). This risk easing by day 3 (03 Mar), with activity becoming Quiet with Unsettled intervals with a decreasing chance of Active intervals.

Geomagnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	40	10	1	1
Strong	G3	No	5	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R⊙ (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed (km/s)	Estimated Arrival Time (UTC)	Comments
26/2030	Partial	Filament	22S26E	800	01/0600 UTC +/- 6hrs	Chance of glance early on 01 Mar.

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Figure 2: MOSWOC Enlil showing easing fast winds.

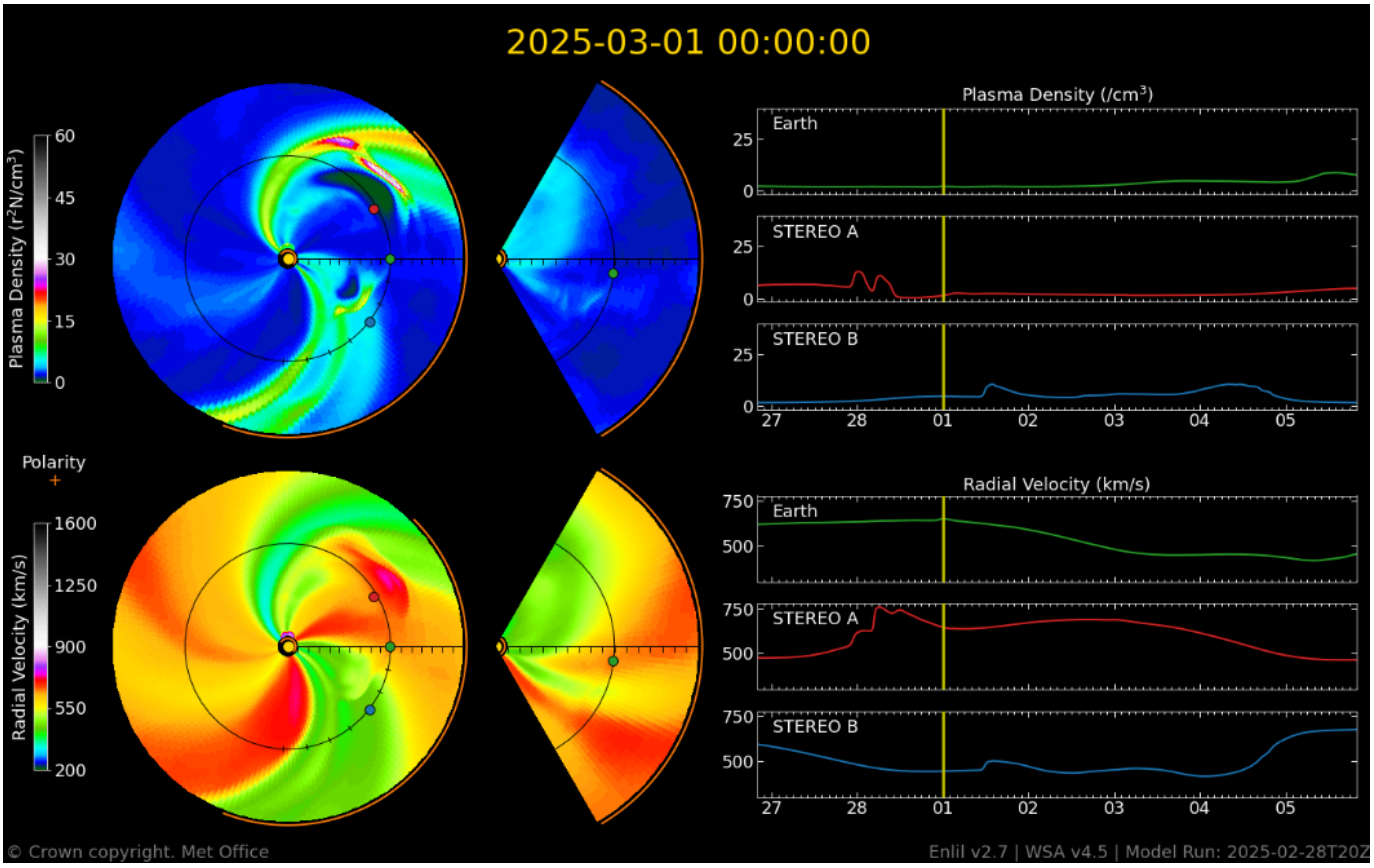
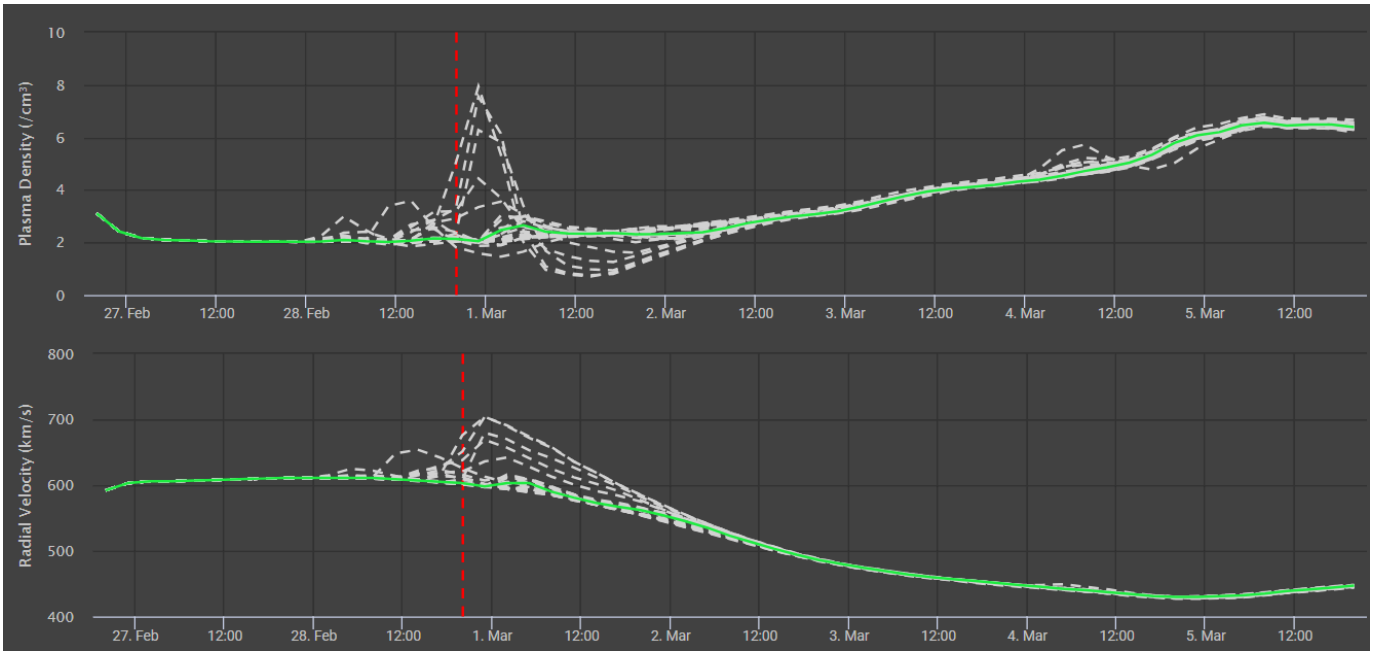


Figure 3: MOSWOC Enlil Ensemble showing chance of glancing CME early on 01 Mar



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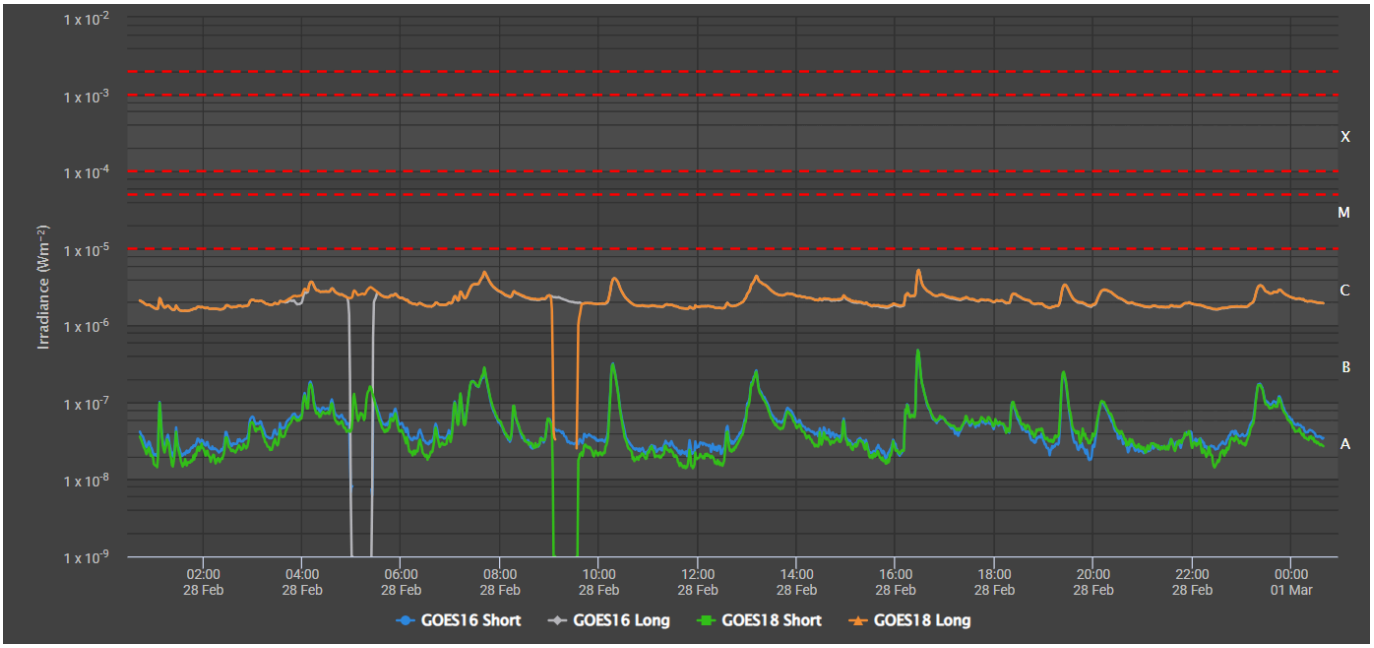
Radio Blackouts - X-Ray Flares

Low to Moderate activity is forecast with a chance of isolated M-class flares.

Of the seven regions currently on the Earth-facing disc, the two rapidly developing regions, AR4007, just west of the south-centre disc, and AR4009 in the northeast, are the most likely sources of any notable activity. AR4007 is of particular note due to its unusual gamma Mount Wilson structure, with both the leader and trailer positive polarity, and a collection of negative polarity intermediate spots. While this is currently a small region, ongoing growth is likely and given the slightly more complex magnetic structure, this increases the potential for flare activity from this region. Despite also seeing rapid development, AR4009 has a more typical bipolar structure, and is maturing and separating into a more open group. However, given its rapid development on 28 Feb, further growth is possible. The other regions on the disc are largely smaller and simpler although AR4006 in the north-centre has been the source of a couple of C-class flares on 28 Feb, and also has a nearby filament that increases the potential for an isolated M-class flare from this region.

X-Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 (M Class)	No	50	50	50	50
Very Active	R3-R5 (X Class)	No	5	5	5	5

Figure 4: GOES-16/18 X-ray Irradiance



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Solar Radiation Storms (High Energy Protons)

GOES-18 high energy (>10MeV) proton flux is at background, and expected to remain at this level. There is a slight chance of enhancement given any significant eruption from the sunspot regions currently on the Earth-facing disc.

Radiation Storms Probability (Exceedance)	Level ($cm^{-2}sr^{-1}s^{-1}$)	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and/or 50 MeV ≥ 10pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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High Energy Electrons (≥ 2MeV)

The high energy electron flux (>2MeV), as observed at GOES-16, has risen from Background to give a period of Moderate flux. This was due to the recent charging of the outer Van Allen Belt from the fast wind enhancement from CH18/+. Subsequently, this rising trend is expected to continue through the period, as the Strong solar winds, and the peak electron flux through the Belt expands outwards towards GEO. Persistently Moderate is likely to develop with periods of High, and perhaps becoming persistently High by day 3 (03 Mar).

The associated 24 hour fluence is expected to see a rising trend, likely rising above the Active level by the end of day 3 or day 4 (03-04 Mar). This rising trend is supported by MOSWOC REFM, although this potentially too quick with the likely enhancement, and overestimating the likely value.

GEO Electron Environment Probability (Exceedance)	Level ($cm^{-2}sr^{-1}$ day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ 1×10^{8}**	No	5	20	60	50
Very Active	**≥ 2 MeV ≥ 1×10^{9}**	No	1	1	1	1

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Figure 5: GOES 16>2MeV electron flux (top) and 24 hr fluence with REFM forecast (bottom)

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